



Data Sheet for Chemistry

GCE Advanced level and Advanced Subsidiary

Chemistry 3882, 7882

Chemistry units 2811 – 2816

These data are for the use of candidates following Chemistry 3882 or 7882.

Clean copies of this sheet must be issued to candidates in the examination room, and must be given up to the invigilator at the end of the examination.

Copies of this sheet may be used for teaching.

Characteristic infra-red absorptions in organic molecules

bond	location	wavenumber
C–O	alcohols, esters	1000 – 1300 cm ⁻¹
C=O	aldehydes, ketones, carboxylic acids, esters	1680 – 1750 cm ⁻¹
O–H	hydrogen bonded in carboxylic acids	2500 – 3300 cm ⁻¹ (broad)
N–H	primary amines	3100 – 3500 cm ⁻¹
O–H	hydrogen bonded in alcohols, phenols	3230 – 3550 cm ⁻¹
O–H	free	3580 – 3670 cm ⁻¹

Chemical shifts for some types of protons in n.m.r. spectra

- Chemical shifts are for hydrogen relative to TMS (tetramethylsilane)
- Chemical shifts are typical values and can vary slightly depending on the solvent, concentration and substituents.

type of proton	chemical shift, δ
$\text{R}-\text{CH}_3$	0.7 – 1.6
$\text{R}-\text{CH}_2-\text{R}$	1.2 – 1.4
R_3CH	1.6 – 2.0
$\begin{array}{c} \text{O} \\ \parallel \\ -\text{C}-\text{CH}_3 \end{array}$ $\begin{array}{c} \text{O} \\ \parallel \\ -\text{C}-\text{CH}_2-\text{R} \end{array}$	2.0 – 2.9
$\text{C}_6\text{H}_5-\text{CH}_3$ $\text{C}_6\text{H}_5-\text{CH}_2-\text{R}$	2.3 – 2.7
$-\text{O}-\text{CH}_3$ $-\text{O}-\text{CH}_2-\text{R}$	3.3 – 4.3
$\text{R}-\text{OH}$	3.5 – 5.5
$\text{C}_6\text{H}_5-\text{OH}$	6.5 – 7.0
$\text{C}_6\text{H}_5-\text{H}$	7.1 – 7.7
$\begin{array}{c} \text{O} \\ \parallel \\ \text{R}-\text{C}-\text{H} \end{array}$ $\begin{array}{c} \text{O} \\ \parallel \\ \text{C}_6\text{H}_5-\text{C}-\text{H} \end{array}$	9.5 – 10
$\begin{array}{c} \text{O} \\ \parallel \\ -\text{C}-\text{OH} \end{array}$	11.0 – 11.7

The Periodic Table of the Elements

[illegible]

lanthanides	140 Ce cerium 58	141 Pr praseodymium 59	144 Nd neodymium 60	– Pm promethium 61	150 Sm samarium 62	152 Eu europium 63	157 Gd gadolinium 64	159 Tb terbium 65	163 Dy dysprosium 66	165 Ho holmium 67	167 Er erbium 68	169 Tm thulium 69	173 Yb ytterbium 70	175 Lu lutetium 71	
	actinides	– Th thorium 90	– Pa protactinium 91	– U uranium 92	– Np neptunium 93	– Pu plutonium 94	– Am americium 95	– Cm curium 96	– Bk berkelium 97	– Cf californium 98	– Es einsteinium 99	– Fm fermium 100	– Md mendelevium 101	– No nobelium 102	– Lw lawrencium 103

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